AMF

Venner

500 MHz Divider
Model 7500

MP MASTER
MA24443

500MHz DIVIDER
MODEL 7500

Instruction Manual

© 1973 AMF | VENNER

VENNER
A Divison of AMF INTERNATIONAL LIMITED
Kingston By-Pass,New Malden,Surrey,KT34PB,England
Telephone: 01-942 2442 Telex: 929828

Publication Ref. IM7500/NLA/BRE/12.73/Issue 3

PREFACE

Notice of amendments applicable to this manual will be presented on pages bound immediately before the rear cover and headed 'CORRIGENDA'

TABLE OF CONTENTS

Section		Page
1	INTRODUCTION	1
2	SPECIFICATION	2
	2.1 Power Supply	2
	2.2 Input	2
	2.3 Output	2
	2.4 Temperature Range	2
	2.5 Dimensions & Weight	2
3	OPERATION	3
	3.1 Mains-voltage Setting & Mains Fuse Rating	3
	3.2 Supply Connection	4
	3.3 General Operation	4
4	MAINTENANCE	5
	4.1 Case Removal	5
	4.2 Fuses	5
	4.3 Module Complement	5
	4.4 Alignment	6
	4.4.1 D.C. Supplies	6
5	CIRCUIT DESCRIPTION	7
	5.1 Circuit Diagrams	7
	5.2 Power Supply (Module type 77/240)	7
	5.3 U.H.F. Amplifier & Decade (Module type 77/410)	7
	5.4 H.F. Decade & Lamp Driver (Module type 77/420)	8

ILLUSTRATIONS & COMPONENTS LISTS:

Title	Components List	Board Layout Diagram	Circuit/ Diagram
Power Supply type 77/240	CL.77/240	BL77/240	E70/31
H.F. Decade & Lamp Driver type 77/420	CL.77/420	BL77/420	E70/33
U.H.F. Amplifier & Decade type 77/410	CL.77/410	BL77/410	E70/32
Main Assembly Model 7500	CL.7500	-	E70/39
Instrument Layout Model 7500	-	-	S73/25

Section 1 INTRODUCTION

The Model 7500 frequency divider has an input frequency range of 15MHz to at least 500MHz and caters for division by 10 and 100. It is a compact solid-state instrument designed primarily as frequency-range extension unit for most commercially available counters that have a relatively low maximum frequency limit.

Indication that the input signal amplitude is adequate for correct operation of the internal frequency-dividing circuits is given by illumination of a solid-state panel-mounted lamp.

The divider may be supplied as a free-standing unit or mounted with one of the Venner '77' series of digital counters in a dual-housing to form a compact 500MHz counting system. A dual-housing kit can be supplied for a pair of instruments originally purchased as free standing units.

SPECIFICATION

2.1 POWER SUPPLY

100-125V/200-250V

45-60Hz/400Hz

Consumption: 15W

2.2 INPUT

NOTE The specification is valid for continuous sinusoidal inputs only. Erroneous operation may occur for amplitude modulated signals and mark/space ratios exceeding 60:40.

Frequency Range:	15MHz to at least 500MHz
Sensitivity:	20mV rms (sinewave)
Maximum Amplitude:	350mV rms normal continuous input.
	CAUTION: Should the input exceed 3V rms the input circuit may be damaged.
Impedance:	50Ω (nominal)
Level Indicator Lamp:	Illuminated when input amplitude exceeds 50mV rms (nominal).

2.3 OUTPUT

NOTE Both outputs are capacitor coupled.

Frequency:	At ÷10 socket: Input frequency divided by 10
	At ÷100 " : " " " " 100
Waveform:	Rectangular
Rise/Fall Time:	Not greater than 5ns (for 50Ω termination)
Amplitude:	400mV peak-to-peak (open circuit)
Impedance:	Nominally 50Ω in series with 0.047μF.

2.4 TEMPERATURE RANGE

-10^{o} to $+50^{o}$ Centigrade

NOTE The instrument may be operated at temperatures down to -10^{o}C and up to $+55^{o}$C but in these cases certain of the parameter values specified above may be degraded.

2.5 DIMENSIONS AND WEIGHT

Free-standing Unit

Width:	112mm
Height:	90mm
Depth:	288mm
Weight:	1.75kg

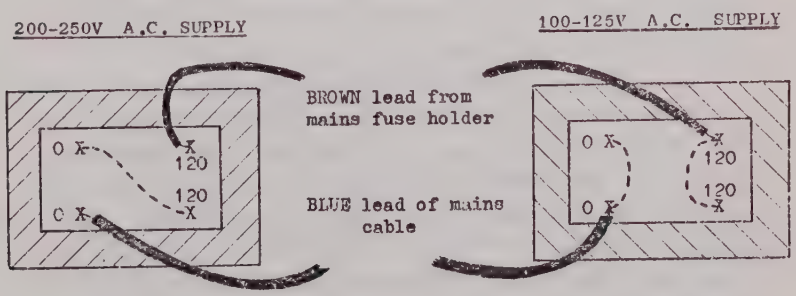
3.1 MAINS-VOLTAGE SETTING

Before connecting the instrument to a mains supply check that the internal transformer is appropriately connected for the required supply voltage range:100-125V or 200-250V. The setting may be indicated on a label attached to the mains cable; however, if inspection at the transformer is necessary, proceed as follows.

Free the rear panel by withdrawing its four corner-mounted securing screws; then carefully ease away the panel (which will be clamped to the supply cable) to give access to the mains transformer at the rear of the chassis.

The transformer has two 120V primary windings terminated at tags visible from the rear of the unit. These windings should be connected in series for supplies in the range 200-250V, but in parallel for supplies in the range 100-125V; the appropriate connections at the transformer are indicated below.

NOTE 'X' represents tag.
'---'represents wire link.



When the correct connections are established refit and secure the rear panel.

Ensure that a cartridge fuse of appropriate rating for the supply voltage is fitted in the rear-panel-mounted screw-type holder.

Supply Voltage	Fuse Rating
100-125V a.c.	500mA Slow blow
200-250V a.c.	250mA " "

3.2 SUPPLY CONNECTION

The transformer connections and fuse rating having been checked (Section 3.1), set the front-panel-mounted POWER switch to the up (off) position and connect the three-core mains cable to the supply thus:

BROWN	core	: LIVE
BLUE	core	: NEUTRAL
GREEN and YELLOW	core	: EARTH

NOTE When the instrument is housed in combination with one of the Venner '77' series of digital counters the mains cable of the divider unit is internally connected in parallel with that of the counter unit. Suitability of voltage setting and mains fuse rating of each instrument should be verified before the supply is connected.

3.3 GENERAL OPERATION

Set the POWER switch to 'ON'; the adjacent red indicator lamp should light-up.

Make the necessary connections to the INPUT and OUTPUT BNC-sockets by way of coaxial cables that have a characteristic impedance of 50Ω.

The outputs are marked '÷10' (one tenth of the input frequency) and '÷100' (one hundredth of the input frequency) and may be used singley or together; however, for these outputs to be precisely 1/10th or 1/100th of the input frequency (i.e. for correct operation of the divider circuits) it is essential that the input amplitude exceeds a particular threshold voltage. Adequacy of input amplitude is verified by illumination of the INPUT VALID lamp.

When an input signal is present but the INPUT VALID lamp is not illuminated, or if illumination is intermittent (because of input amplitude variation), the output may not conform to the specification given in Section 2.3. However, should the input amplitude lie between the minimum specified value (20mV) and the threshold of lamp illumination, the output may be utilized provided that its validity (dependent upon correct frequency division) is verified by the operator.

Section 4 MAINTENANCE

4.1 CASE REMOVAL

WARNING Whenever the instrument is operated with the case removed, ensure that no physical contact is made with exposed connections; particularly those of the POWER lamp and switch, mains fuse, and primary terminations of the transformer.

The instrument case is in two sections, each secured by two screws at either side of the unit. Removal of the top section gives access to the plug-in printed circuit boards and their preset controls; removal of the lower section gives access to pins of the sockets that unite with the printed circuits, and to connections of the chassis-mounted integrated circuit of the power supply.

4.2 FUSES

Mains Fuse

A cartridge fuse, connected in the LIVE line of the mains input circuit, is housed in a rear-panel-mounted screw-type fuse holder.

The appropriate fuse rating depends upon the supply voltage:

Supply Voltage	Fuse Rating	Venner Part No.
100-125V a.c.	500mA (slow blow)	Z52053/2
200-250V a.c.	250mA (" ")	Z52053/3

D.C. Fuse

A cartridge fuse is connected in the -12V d.c. internal supply circuit; it is housed in a clip-type holder close to the top edge of the plug-in POWER SUPPLY board type 77/240. The fuse is accessible when the top section of the instrument case has been removed.

Fuse: 150mA Venner Part No. Z51971/3

4.3 MODULE COMPLEMENT

The instrument employs three plug-in printed circuit modules that are situated in the unit as indicated in diagram S73/25. The modules are identifiable by their type numbers, which are marked on the plug-in printed circuit boards.

A component layout diagram is provided for each module. These

diagrams are bound with the circuit diagrams near the rear of this manual; the reference numbers of the diagrams appear on page (i).

4.4 ALIGNMENT

The instrument is tested and aligned by special equipment prior to despatch; consequently the settings of the controls should not be altered. It is recommended that in the event of re-alignment being considered necessary the instrument be returned to AMF/Venner.

4.4.1 D.C.Supplies

NOTE Measurement and adjustment of the internal d.c. supplies is treated below, but it should be borne in mind that a change in the preset potentials (even within the stated potential ranges) caused by control adjustment or component renewal may result in there being a slight change in sensitivity within the frequency range of the instrument, and although input/output division ratios should be unaffected the performance of the unit may subsequently not comply fully with the specification presented on page 2.

The Power Supply module type 77/240 provides three stabilized low tension supplies, which may be monitored at pins of the socket that houses the module. The supplies (with respect to the 0V chassis-earth line: pin 16) should be:

Pin No.	Potential
1	+12V ±0.6V
9	+5.2V ±0.1V
2	-12V ±0.8V

NOTE Recommended voltmeter: Universal AVO Meter Model 8. Observe lead polarity when connecting voltmeter.

The potential of the +5.2V supply is adjustable at preset potentiometer R15. However, it is unlikely that the preset line-potential will deviate from the permissible voltage-range unless a fault devlops within the circuit of the instrument; in which case it is advisable to rectify the fault before altering the potentiometer setting*.

The control is mounted close to the top-edge of the power supply board and may be adjusted by gently gripping the outer disc between finger and thumb and partially rotating it in the appropriate direction.

* Renewal of components in some circuit positions will not impair the operation of the unit; however, if after component renewal it is found that the instrument fails to comply with the specification the unit should be returned to AMF/Venner for re-alignment.

5.1 CIRCUIT DIAGRAMS

The main circuit of the instrument appears on diagram E70/39. This diagram shows the arrangement of the mains input circuit and interconnection of the three plug-in printed circuit modules.

The modules are represented in block form; with each block containing the title and type number of the module it represents, together with the reference number of the relevant circuit diagram.

5.2 POWER SUPPLY (MODULE TYPE 77/240)

The circuit of this module appears on diagram E70/31.

The secondary winding of the mains transformer is connected across terminations 12 and 13, and its centre-tap is connected to termination 15.

Three low tension stabilized supplies are produced by the module: (i) +12V available at termination 1 and derived via full-wave rectifying diodes D1&2 and the chassis-mounted integrated circuit, connected to terminations 1,14 & 16 and shown as X1 on diagram E70/39, (ii) +5.2V available at termination 9, preset at R15 and derived from the +12V supply by the transistor circuit of TR4-6 for which D5 serves as voltage reference diode, (iii) -12V derived via full-wave rectifying diodes D3&4, fuse FS2 and the series stabilizer circuit of TR1-3, which is controlled by the voltage produced at potential divider junction R13/R14.

5.3 UHF AMPLIFIER & DECADE (MODULE TYPE 77/410)

Signals at the input frequency, received at SK1 (Drg. E70/32), are applied to a.c.-coupled grounded-base amplifier TR1.

The amplifier provides a gain of approximately 2 and employs L1 and L2 for inductive peaking of high frequency response.

This stage is followed by three cascade connected grounded-emitter amplifiers. The first (TR2) is d.c.-coupled by Zener diode D1; it has a gain of approximately 3 and includes capacitor C6 as preset H.F. response control. The next stage is coupled by Zener diode D3 and is the frequency compensated amplifier TR3, which employs preset capacitor C11 in its frequency compensation circuit. The final amplifier of the trio (TR4) is directly coupled and its H.F. response is preset by capacitor C18.

For the mean output potential of TR4 to be held at a constant level, feedback from TR4-collector is applied to the emitter circuit of TR3. The d.c. component of the TR4 collector output is fed via low-pass filter R25-C19 to the differential/d.c. amplifier circuit of TR10&11, where it is compared with a reference potential preset at R39. The amplified feedback signal from TR10 is then applied to the emitter circuit of TR3 by way of TR12.

Signals produced at TR4 collector drive the circuit of TR5-TR6, which is basically that of a Schmitt trigger stage. For input frequencies below 100MHz the Schmitt circuit has the usual hysteresis; but at higher frequencies this hysteresis is diminished, due to a finite frequency response of D5&6 and TR6, and so the circuit behaves as a grounded-emitter amplifier.

The Schmitt/amplifier circuit serves to provide suitable trigger signals, over the input frequency range, for operation of the a.c.-coupled integrated-circuit frequency divider decade X1.

Output pulses (one per ten input pulses) produced at pin 4 of the decade, feed the circuit of TR7 and TR8, which is a long-tailed-pair buffer/output stage that is overdriven to provide approximately rectangular output pulses and includes potentiometer R43, preset for optimum pulse shape.

A negative potential whose level is dependent upon input signal amplitude is produced at the DETECTOR OUTPUT; it is derived from the second amplifier (TR2-collector) by C9 and the rectifier/filter circuit of D4-R24-C20.

Supply voltage stabilization, additional to that of the power supply module, is provided by the Zener-voltage controlled series regulator circuits of TR9 and TR13, which automatically compensate for temperature change at the module.

5.4 HF DECADE & LAMP DRIVER (MODULE TYPE 77/410)

Diagram E70/33 shows the HF decade (lower region) together with the drive circuit of the INPUT VALID lamp (upper region).

H.F. Decade:

Signals from the first (or VHF) decade are received across terminations 14 & 16 and pass via the pulse shaper circuit of TR1 & 2 to drive integrated circuit frequency divider decade X2.

The signals produced at pin 2 of the decade drive the buffer/output stage containing TR3 & TR4, which are arranged in a long-tailed-pair configuration. The stage is capacitively coupled to the coaxial output socket by C9.

Lamp Drive Circuit:

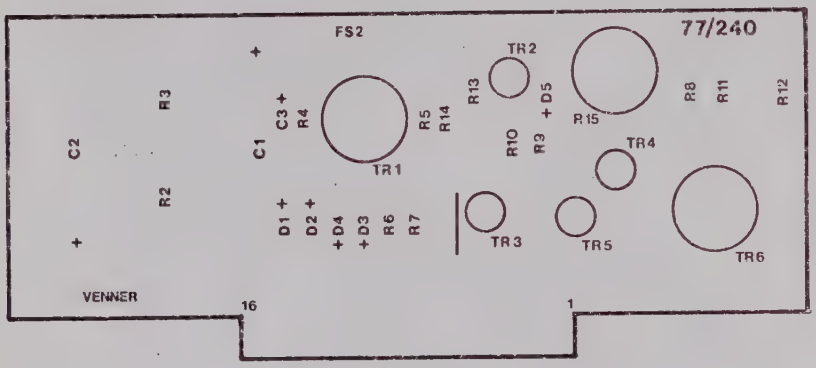
The DETECTOR OUTPUT signal of the UHF AMPLIFIER & DECADE board is received at termination 15. This signal, whose level is proportional to the amplitude of the signal applied to the instrument, is fed via the low pass filter comprising C3-R6 (and C20-R24 of the preceding board) to one input (pin 2) of a high gain differential amplifier contained in integrated circuit X1.

The second input (pin 1) of the amplifier receives feedback via R11 and the reference voltage derived from the +5.2V supply by the potential divider chain R1-3, which includes D1 as temperature compensating diode and R3 as preset threshold level control.

An input differential of 100mV produces a change in output of approximately 1V. The output (produced at pin 12) is used to operate a Schmitt trigger circuit, which constitutes the second stage within X1. When the amplitude of the signal applied to the instrument is sufficient for correct operation of the frequency divider circuits, the Schmitt circuit is triggered and supplies illuminating current to the INPUT VALID lamp (L2 of Drg.E70/39) via current limiter R17.

POWER SUPPLY TYPE 77/240 (DRG. E70/31)

	Value or Type	Description	Venner Part No.
Capacitors			
C1	470µF		X20643/98
C2	1000µF		" /97
C3	2.2µF		X22776/22
Diodes			
D1-4	1N4002		X20639/60
D5	BZY88 C5V6		" /30
Fuse			
FS2	150mA		Z51971/3
Resistors			
R2	10kΩ ¼W ±5%		X50500/73
R3,4	4.7kΩ " "		" /65
R5	680Ω " "		" /45
R6	3.3kΩ " "		" /61
R7	100Ω " "		" /25
R8,11	1kΩ " "		" /49
R9	5.6kΩ " "		" /67
R10	560Ω " "		" /43
R12	27Ω 4W "		Y50510/9
R13	6.8kΩ ¼W ±2%		X50502/22
R14	6.2kΩ " ±1%		" /86
R15	1kΩ		X20999/58
Transistors			
TR1,6	2N3053		X20638/66
TR2,3	BCY70		" /80
TR4,5	BC108		" /71

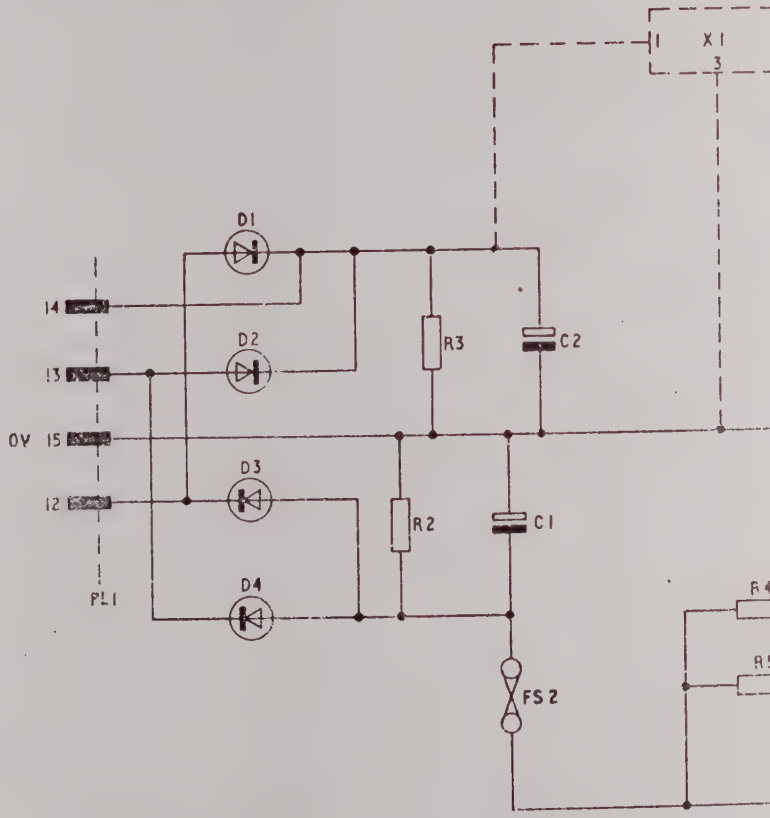


VIEWED FROM COMPONENT SIDE

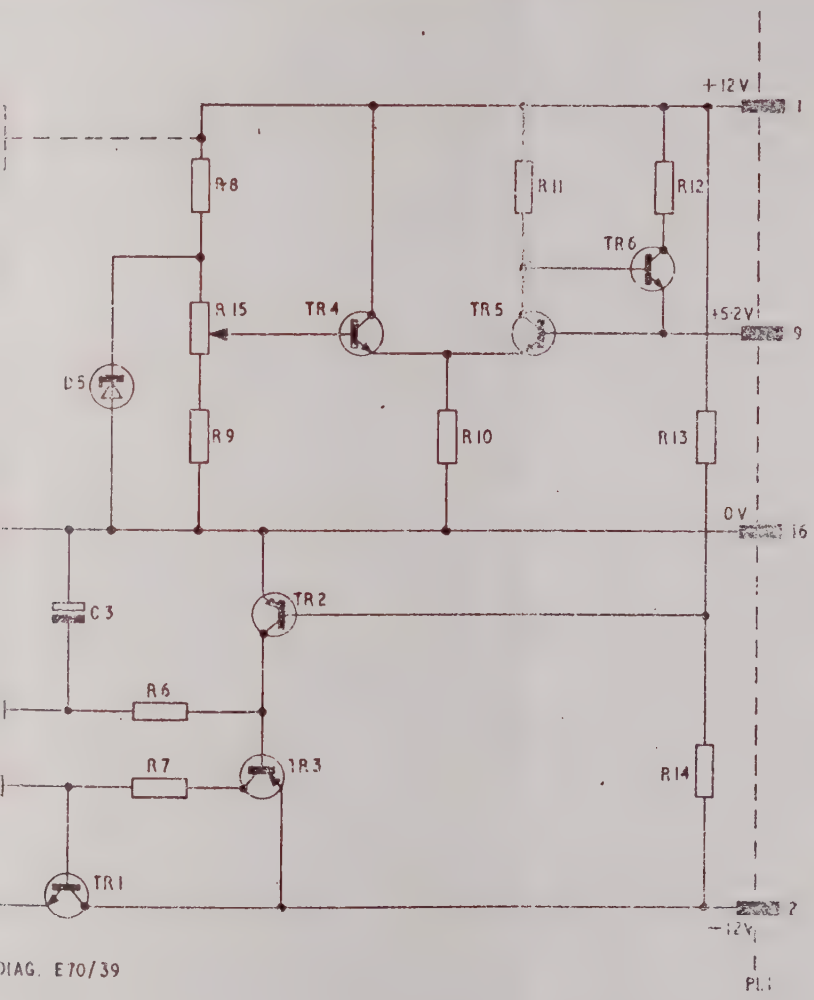
REF
M3112

POWER SUPPLY
TYPE 77/240

BL
77/240



NOTE
X1 IS CHASSIS MOUNTED AND IS SHOWN ON WIRING

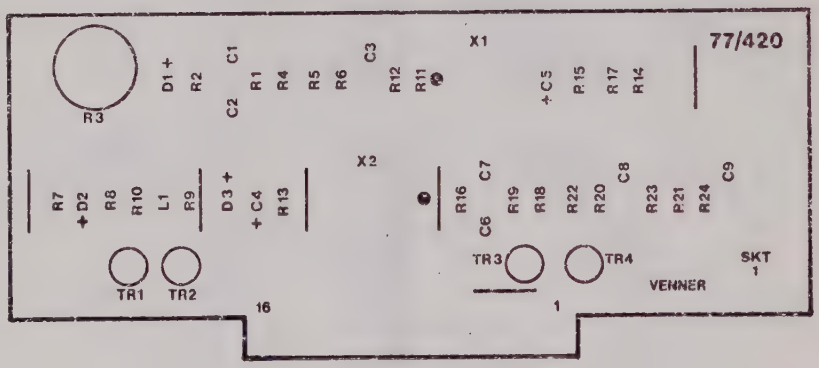


DIAG. E70/39

POWER SUPPLY
CCT. DIAGRAM
TYPE 77/240
Dwg. No. E70/31 ISS. B

H.F. DECADE & LAMP DRIVER TYPE 77/420 (DRG. E70/33)

	Value or Type	Description	Vernier Part No.
Capacitors			
C(1-3),6,8,9	0.047µF		X20641/55
C4,5	15µF 20V		X22776/20
C7	22pF		X50509/2
Diodes			
D1		5082-2800	X20639/67
D2,3		D31	" /31
Inductor			
L1		SC10	Z52616
Integrated Circuits			
X1		SN72747	X50520/48
X2		SN74196N	" /22
Resistors			
R1,4	56kΩ ¼W ±5%		X50500/91
R2,23	3.9kΩ " "		" /63
R3	1kΩ		X20999/58
R5,6,18,22	1kΩ ¼W ±5%		X50500/49
R7,15	150Ω " "		" /29
R8	2.4kΩ " "		" /58
R9	470Ω " "		" /41
R10	1.2kΩ " "		" /51
R11,12	220kΩ " "		X50501/9
R13	2.2kΩ " "		X50500/57
R14	10kΩ " "		" /73
R16	10Ω " "		" /1
R17	330Ω " "		" /37
R19	1.5kΩ " "		" /53
R20	680Ω " "		" /45
R21	47Ω " "		" /17
R24	4.7kΩ " "		" /65
Socket			
SK1		Mini coaxial	X50508/28
Transistors			
TR1,2	T/55		X20638/55
TR3,4	V405A		" /65

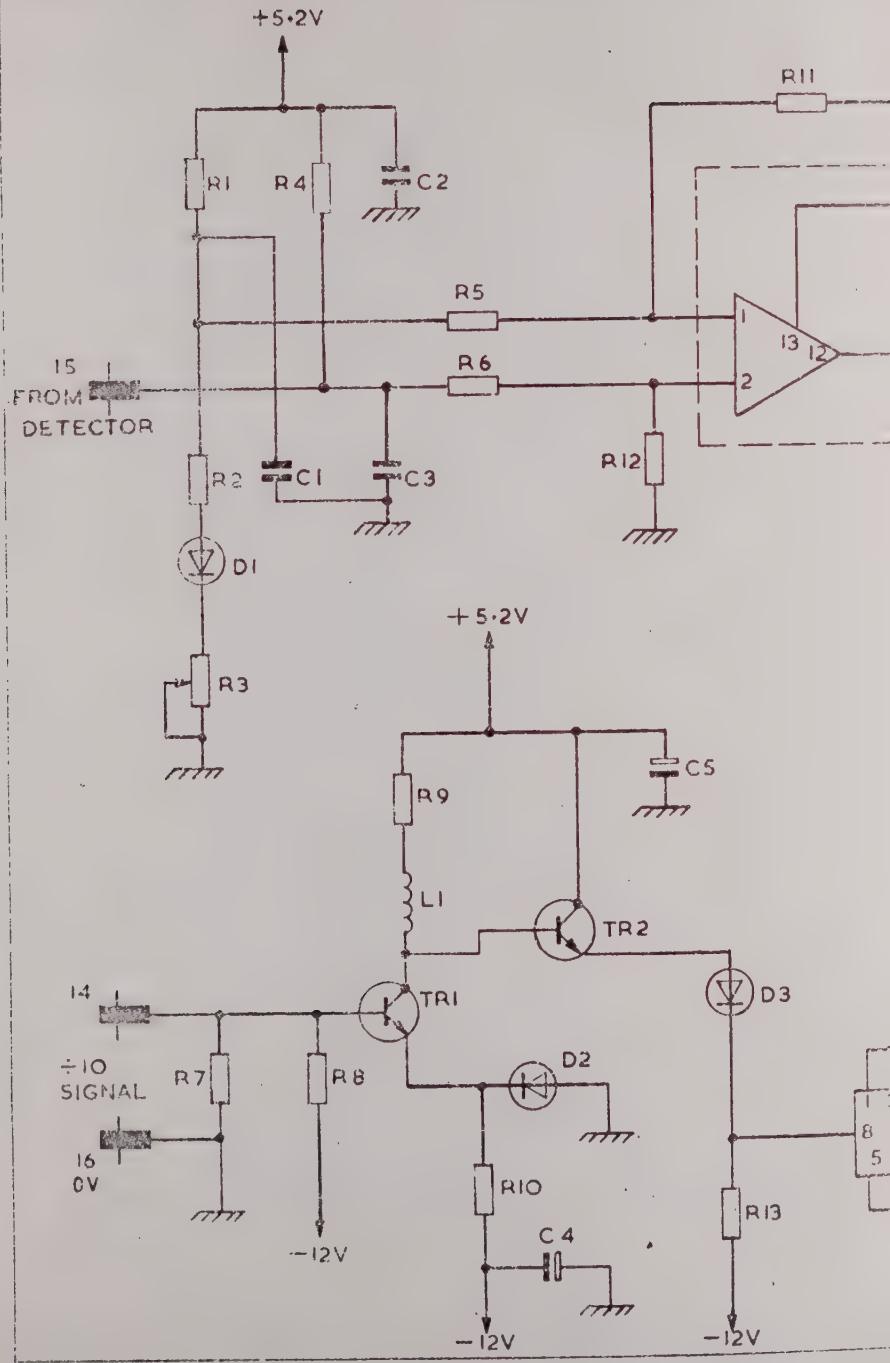


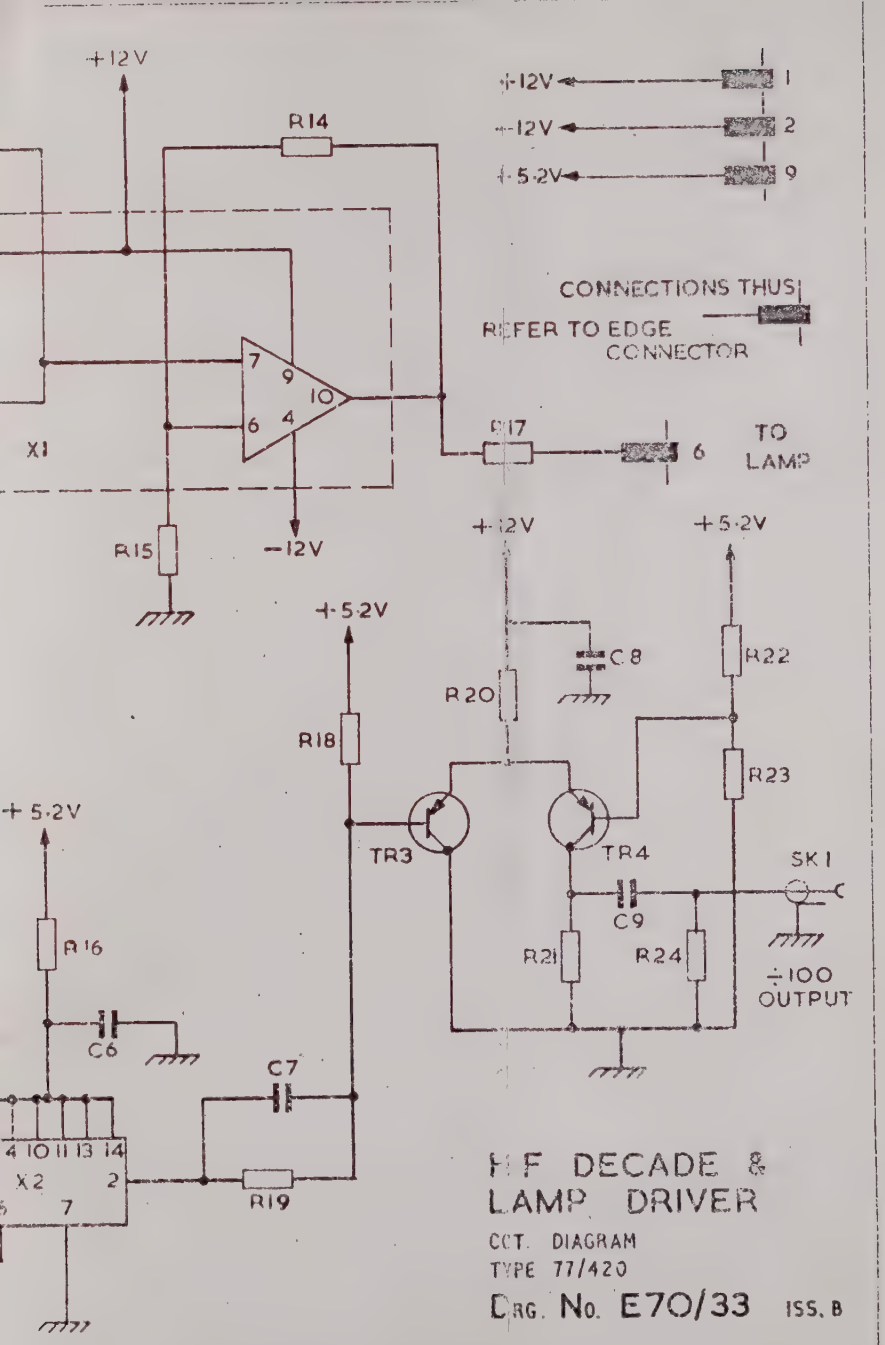
VIEWED FROM COMPONENT SIDE

REF
M3114

HF DECADE AND
LAMP DRIVER
TYPE 77/420

BL
77/420


+5·2V
R11
R1
R4
C2
R5
15
FROM
DETECTOR
R6
1
13
12
2
R2
C1
C3
R12
D1
+5·2V
R3
C5
R9
L1
TR2
14
TR1
D3
÷10
SIGNAL
R7
R8
D2
16
0V
R10
R13
C4
−12V
−12V
−12V
8
5



H.F. DECADE & LAMP DRIVER

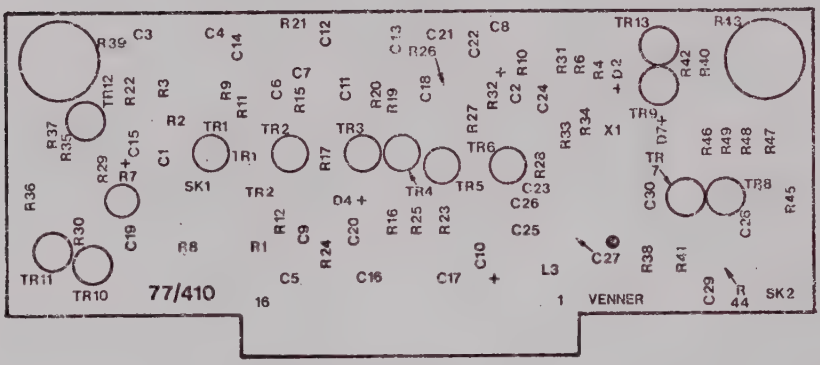
CCT. DIAGRAM
TYPE 77/420

DRG. No. E70/33 ISS. B

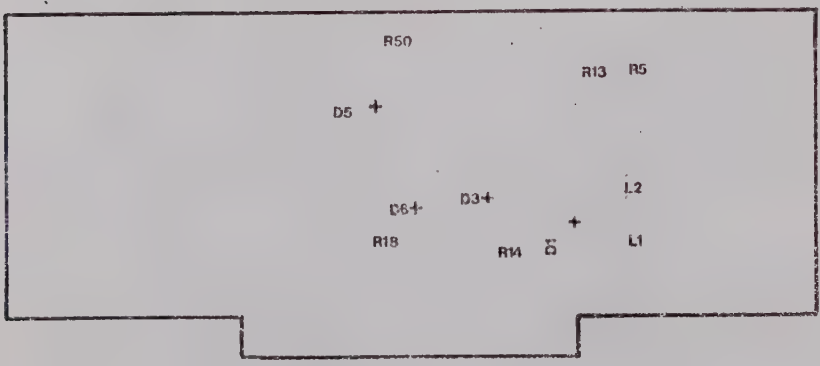
UHF AMPLIFIER & DECADE TYPE 77/410 (Drg.E70/32)

	Value or Type	Venner Part No.
Capacitors		
C1,2,19,20,24-29	0.047µF (25V)	X20641/55
C3,4,5,7,16,17,21	1kpF	Y50525/2
C6,18	3.5-15pF Trimmer	X21135/16
C8,10	33µF (10V)	Y50518/2
C9,14	1kpF	X20641/56
C11	2-10pF Trimmer	X21135/18
C12,22,30	6.8pF (50V)	Y20644/26
C13	33pF	X20641/59
C15	15µF (16V)	Y50518/4
C23	0.001µF	X20641/69
Diodes		
D1	BZY88 C3V9	X20639/66
D2,7	" C10	" /57
D3	" C7V5	" /42
D4	5082-2800	" /67
D5	BAW 62	" /58
D6	BZY88 C4V7	" /33
Inductors		
L1	7mm I/D 1½ turns 22swg. TC.	-
L2	6mm " 4½ " " " "	-
L3	--	Y52154/1
Integrated Circuit		
X1	SP630B	X50520/54
Resistors		
R1	150Ω ± 5% (0.33W)	X50517/15
R2	47Ω ±10% (0.25W)	X52902/9
R3	820Ω ± 5% (0.33W)	X50517/24
R4,42	330Ω " "	" /19
R5,10,13,14,18,31,50	10Ω " "	" /1
R6,40	15Ω " "	" /3
R7	100Ω --	X20999/99
R8	270Ω ± 5% (0.33W)	X50517/18
R9,22,35	3.3kΩ " "	" /31
R11,20	33Ω " "	" /6
R12,21	100Ω " "	" /13
R15	1.5kΩ " "	" /27
R16,41	470Ω " "	" /21
R17	22Ω " (0.2W)	X50514/5
R19	12Ω " (0.33W)	X50517/2

	Value or Type	Venner Part No.
R23	180Ω ± 5% (0.33W)	X50517/16
R24,30,32,45	4.7kΩ " "	" /33
R25,26,29,38	1kΩ " "	" /25
R27	47Ω " (0.2W)	X50514/9
R28	22Ω " (0.33W)	X50517/5
R33,44	47Ω " "	" /9
R34	15kΩ " "	" /39
R36,47	2.2kΩ " "	" /29
R37	10kΩ " "	" /37
R39	4.7kΩ --	X20999/63
R46,49	680Ω " (0.33W)	X50517/23
R48	8.2kΩ " "	" /36
R43	22kΩ --	X20999/79
Sockets		
SK1,2	Miniature Coaxial	X50508/28
Transistors		
TR1-6	BFY90	X20638/95
TR7,8	V405A	" /65
TR9	T/55	" /55
TR10,11,13	BCY70	" /80
TR12	BC108	/71



VIEWED FROM COMPONENT SIDE

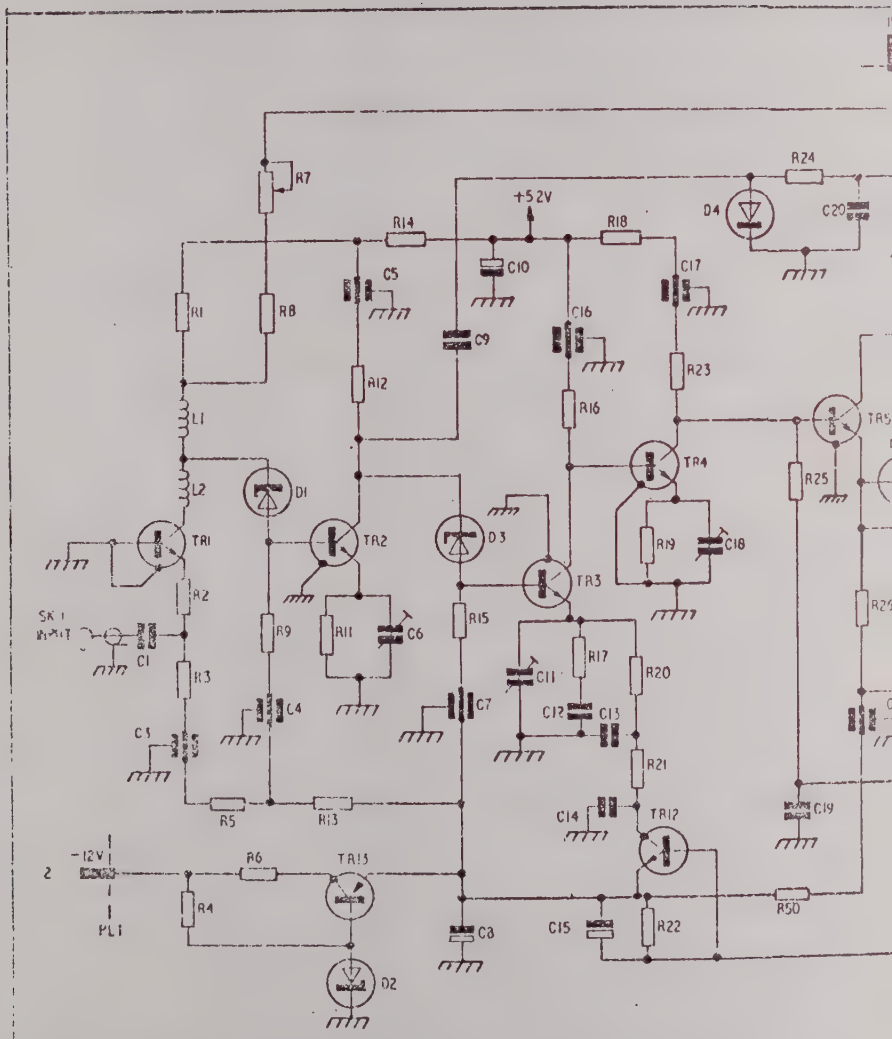


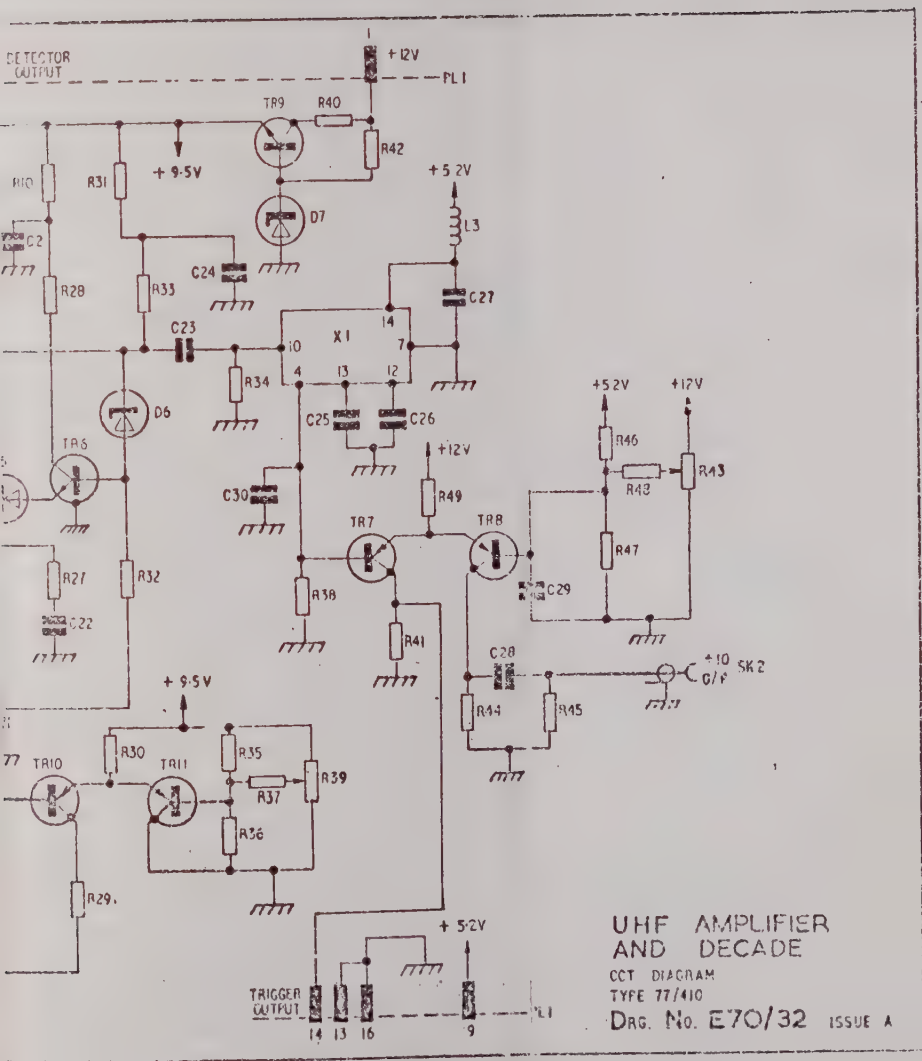
VIEWED FROM COPPER SIDE

REF
M3113

UHF AMP AND DECADE
TYPE 77/410

BL
77/410

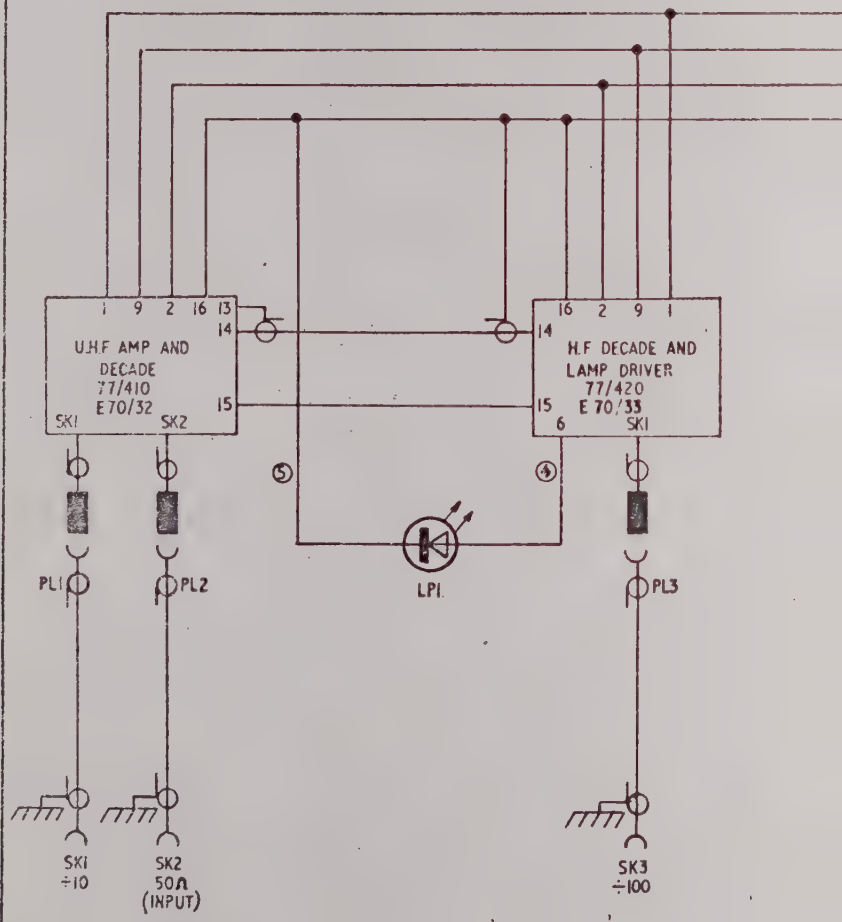

R7
R14
+5.2V
R18
R24
D4
C20
C5
C10
C17
R1
R8
C16
C9
R23
R12
R16
L1
TR4
TR5
L2
D1
R25
TR1
TR2
D3
TR3
R9
C18
R2
R15
SK1
INPUT
C1
R11
C6
R17
R20
R3
C11
C12
C13
C4
C7
C3
R21
R5
R13
C14
TR12
C19
-12V
2
R6
TR13
R4
R50
PL1
C8
C15
R22
D2

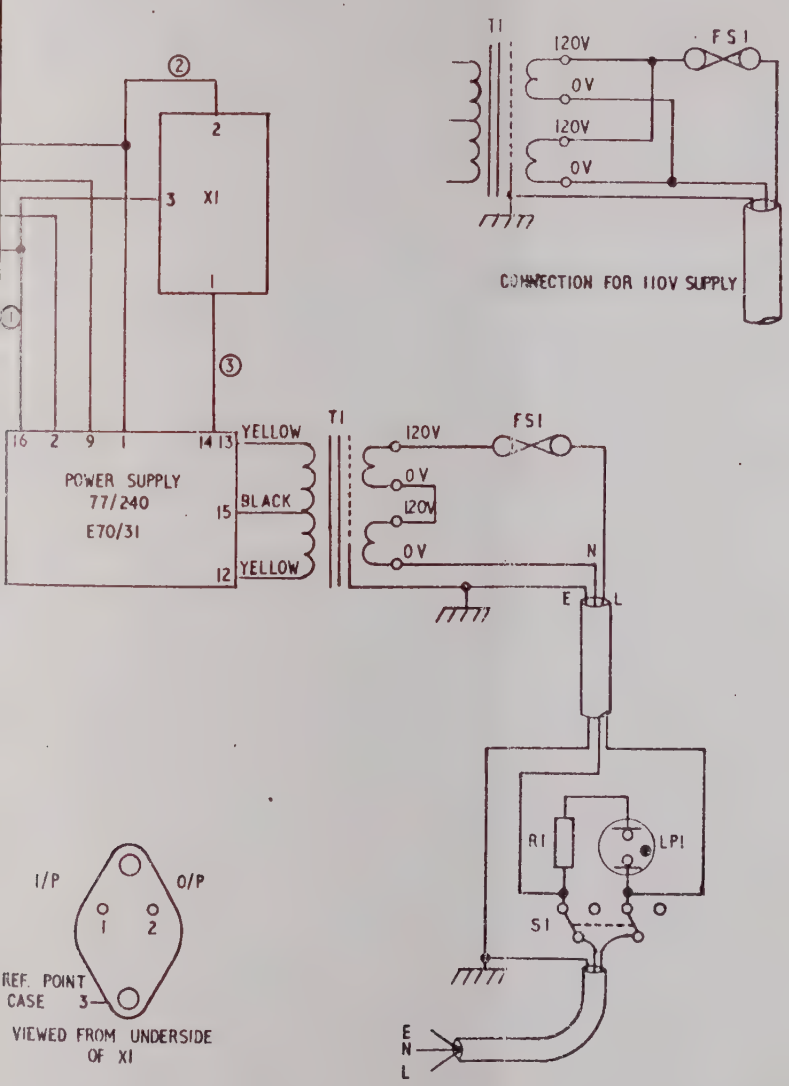

DETECTOR OUTPUT
+12V
PL1
TR9
R40
R42
R31
+9·5V
+5·2V
D7
L3
C24
C27
R28
R33
C23
X1
R34
D6
C25
C26
TR6
C30
R49
TR7
TR8
R46
R43
R48
R47
C29
R27
R32
C22
R38
R41
C28
+10 G/F
SK2
R44
R45
TR10
TR11
R30
R35
R37
R39
R36
R29
TRIGGER OUTPUT
14
13
16
9
UHF AMPLIFIER AND DECADE
CCT DIAGRAM
TYPE 77/410
DRG. No. E70/32
ISSUE A

MAIN ASSEMBLY 7500 (DRG. E70/39)

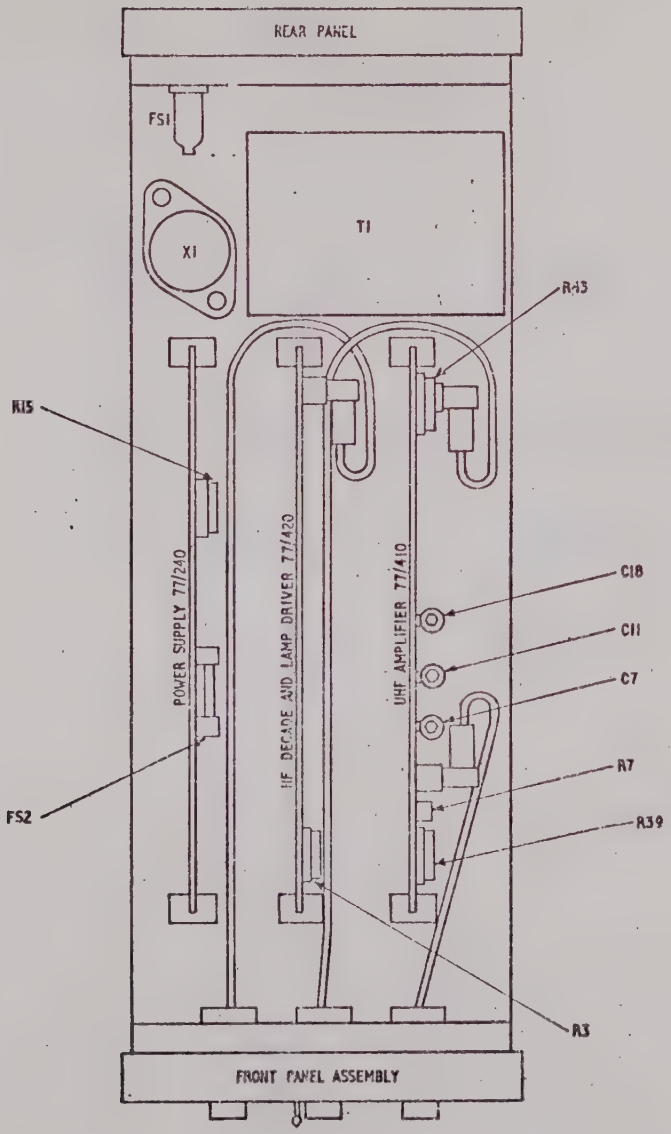
	Value or Type	Description	Venner Part No
Fuse			
F31	250mA	(for 200-250V a.c)	Z52053/3
or	500mA	(" 100-125V ")	Z52053/2
Integrated Circuit			
X1	L036T1	-	X50520/28
Lamps			
LP1		Mains-Neon	Z51400
LP2		'Input Valid'	X52525/1
Plugs			
PL (1-3)		Elbow	X50508/27
Resistor			
R1	270kΩ ¼W ±5%		X50501/11
Sockets			
SK (1-3)		BNC	X50508/26
Switch			
S1		Mains	Z52061
Transformer			
T1		Mains	X52801

Ref: P2379: 3/1B,2B,3C


1 9 2 16 13
14
15
U.H.F AMP AND
DECADE
77/410
E70/32
SK1
SK2
16 2 9 1
14
15
6
H.F DECADE AND
LAMP DRIVER
77/420
E 70/33
SK1
PL1
PL2
LP1
PL3
SK1
÷10
SK2
50Ω
(INPUT)
SK3
÷100



MAIN ASSEMBLY
WIRING DIAGRAM
MODEL 7500
DRG. NO E70/39 ISSUE



NOTE:—ONLY THE MAIN ITEMS SHOWN

500 M Hz DIVIDER
MODEL 7500
LAYOUT DIAGRAM
Dwg. No. S73/25 ISSUE 1

CORRIGENDA

CIRCUIT DIAGRAM E70/32:

Delete C12

Show an additional capacitor (C12) connected in parallel with R34 (i.e. between X1 pin 10 and chassis-earth).

BOARD LAYOUT DIAGRAM BL77/410:

Delete C12 from position shown on COMPONENT SIDE of board.

Capacitor C12 should appear on the COPPER SIDE of board.

COMPONENTS LIST CL77/410:

Resistor value changes:

					Venner Part No
For	R11	read 100Ω	±5%	0.33W	X50517/13
"	R12	" 330Ω	"	"	X50517/19
"	R35	" 3.9kΩ	"	"	X50517/32
"	R37	" 6.8kΩ	"	"	X50517/35

MP MASTER
MA24443

AMF | VENNER A Division of AMF INTERNATIONAL LIMITED
Kingston By-Pass, New Malden, Surrey, KT3 4PB, England.
Telephone 01-942 2442 Telex 929828